

USA Barrel Module Assembly Cluster

Status Report
February 2002

Overview

- USA Cluster is to assemble 670 barrel modules.
 - LBL task: assemble, bond, and test
 - UCSC task: bond and test
- Current schedule: March/02 – Jun/03
 - Mar/02 – Jul/03: 10% 60 in 100 days (3/week)
 - Aug/02 – Dec/02: 40% 270 in 100 days (~2.7/day)
 - Jan/03 – Jun/03: 50% 340 in 120 days (~3/day)
- USA Cluster works closely with RAL in mechanics. Common fixtures, procedures, software. Weekly scheduled phone meetings.

Items required and status

- All systems and infrastructure required for site qualification and early production are in place and functional.
- Certain systems to be expanded to handle full production load – see details as follows.

US Manpower

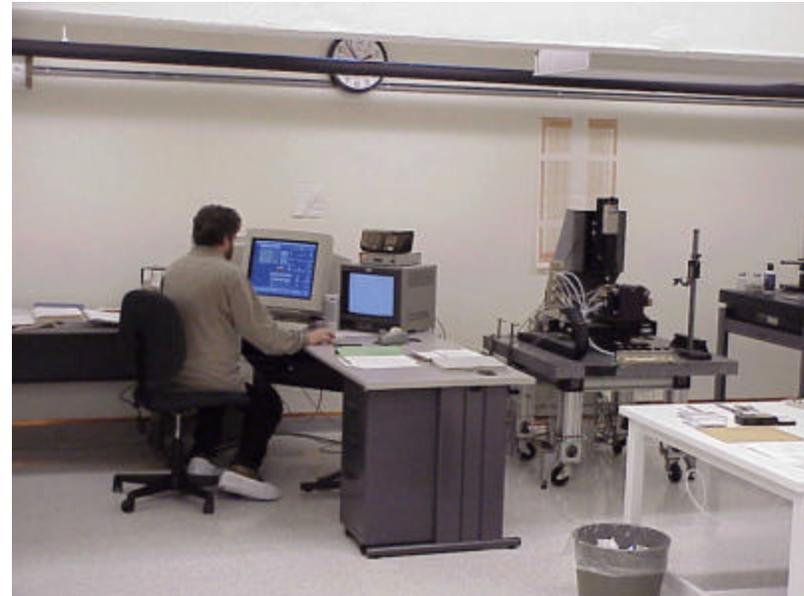
- Module mechanical assembly and metrology:
 - 2 FTE techs
 - 1 post-doc
 - 2 FTE scientist
- Wire bonding:
 - 2.5 FTE techs
- Rework
 - 0.5 FTE techs
- Test/burn-in
 - 3 student
 - 1 post-doc
 - 1.5 scientist

I V Scan

- Probe station in place and functioning.
- Interfaced to LabVIEW control and SCT database.
- User documentation written.

Wafer Alignment System

- System is up and running, in regular use.
- Manchester / RAL code operational.
- Numerous dummy and some electrical modules assembled.



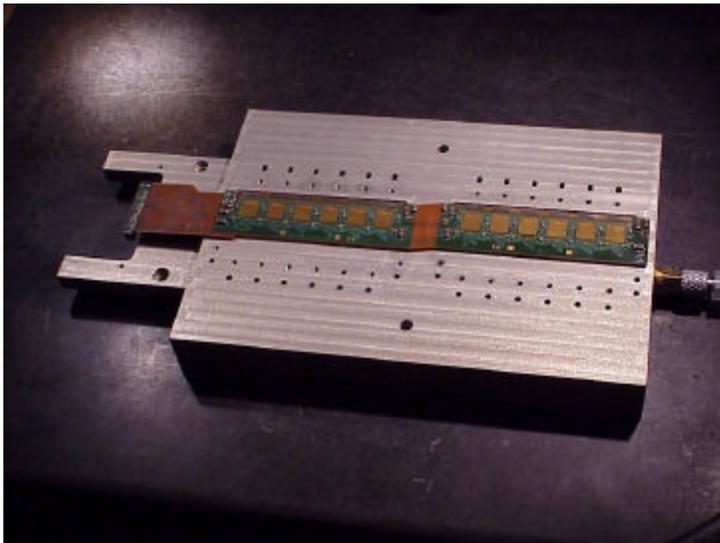
Fixtures (1)

- Year 2000 series RAL assembly fixtures in use for wafer pickup and glue cure.
- New baseboard support plate in use.
- Qualification will use these fixtures.
- Additional sets for production: to order 5 to enable 3 module/day rate.

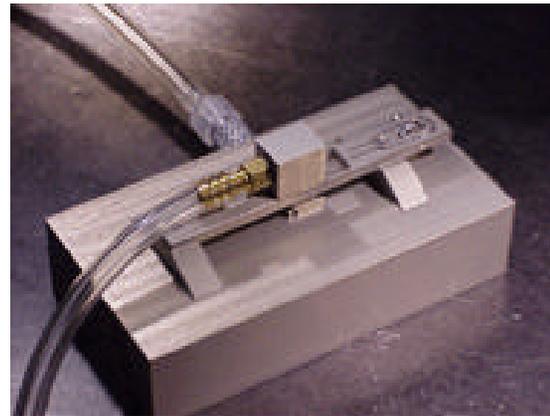
Fixtures (2)

- New hybrid folding fixture in design.
- Prototype in use now, will be used for most of the qualification modules.
- Multi-purpose plate (MPP) for hybrid assembly built.
 - Conducting epoxy application using custom template
 - ASIC placement using custom vacuum tool
 - Wire bonding
 - Test and debug

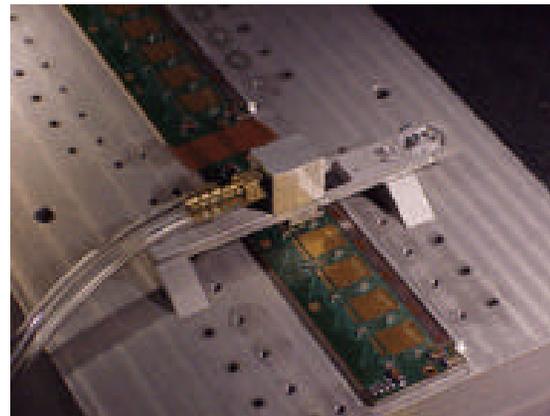
Fixtures (3)



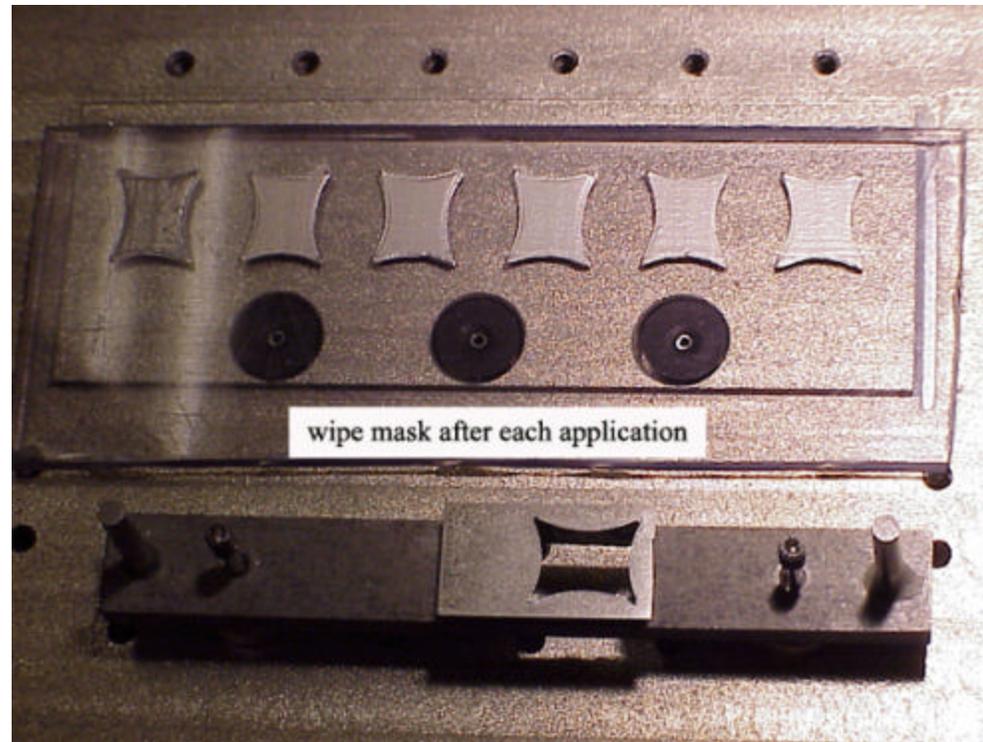
Multi-purpose plate



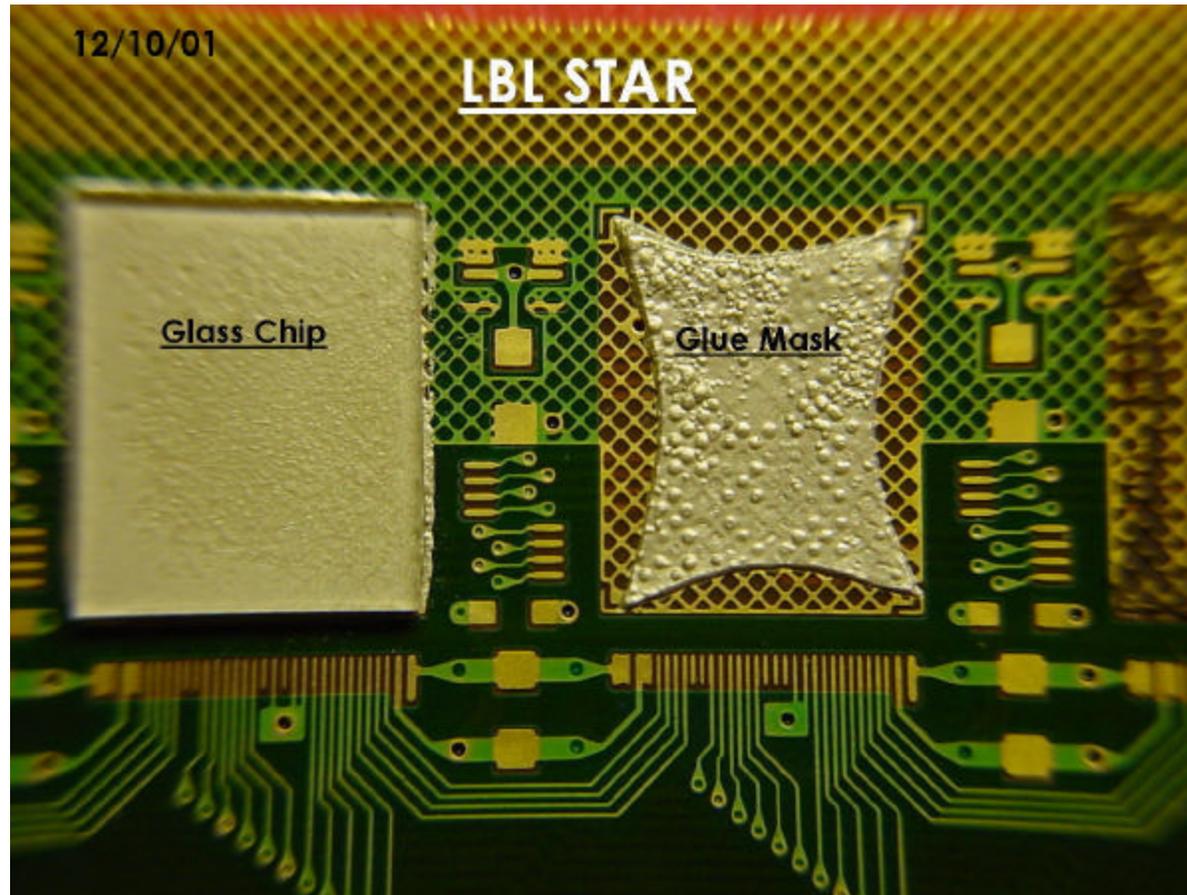
Die pickup



Fixtures (4)

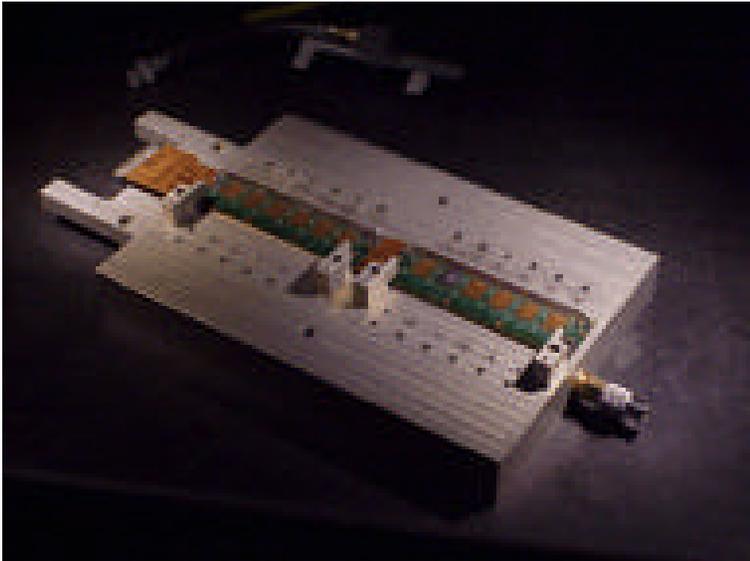


Glue has been applied with template to glass dummy

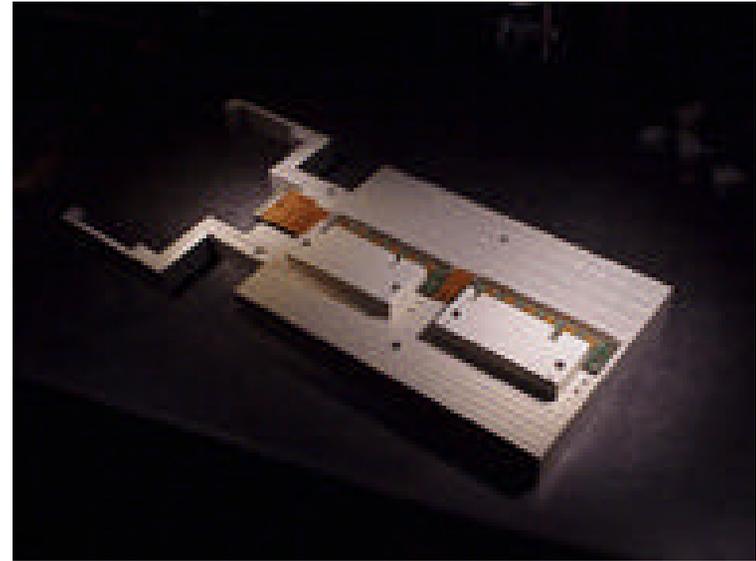


Note: bubbles due to K3 mesh - absent in K5

Fixtures (5)



Wire bonding configuration



Testing configuration to maintain good thermal contact

Module Pickup Tool



Module pickup tool – compatible with RAL fixtures and QMW module testing box. Some modification underway for RAL.

Storage

- Temporary (small volume) inert storage for detectors in place
- Production scale storage in construction
- Will use QMW module storage box, includes modification for new pickup tool.

Glue dispensing (1)



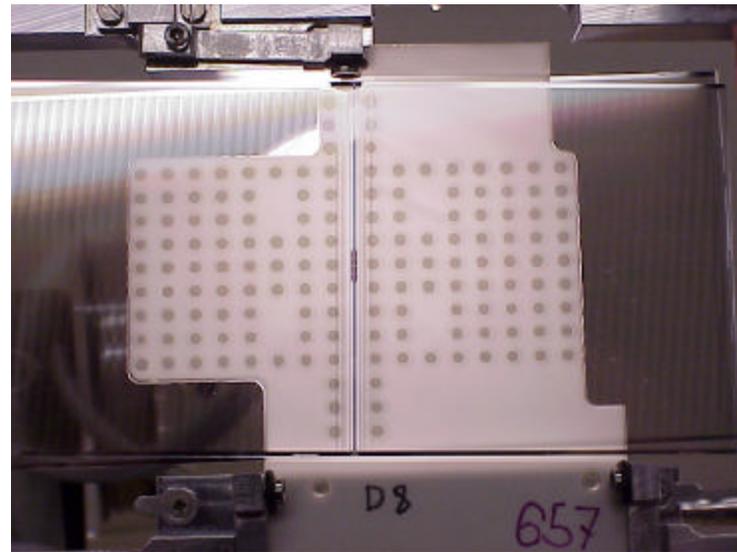
Finisar glue
robot



Keyence mixer

Glue Dispensing (2)

- New Keyence mixing system procured and installed
- Improvement in glue dot uniformity with this system in use.



Bonding

- Two K&S 1470 machines now installed.
- Pull studies on mechanical samples and on K4 electrical parts are acceptable.
- Auto-bonding in regular use.
- New MPP fixture.



Metrology (1)

- Advanced Smart Scope
- Metrology plate as in RAL
- Newly calibrated system
- Automated measurement process
- Analysis format as RAL
- In plane results on Si and glass dummy parts
- Z work in progress

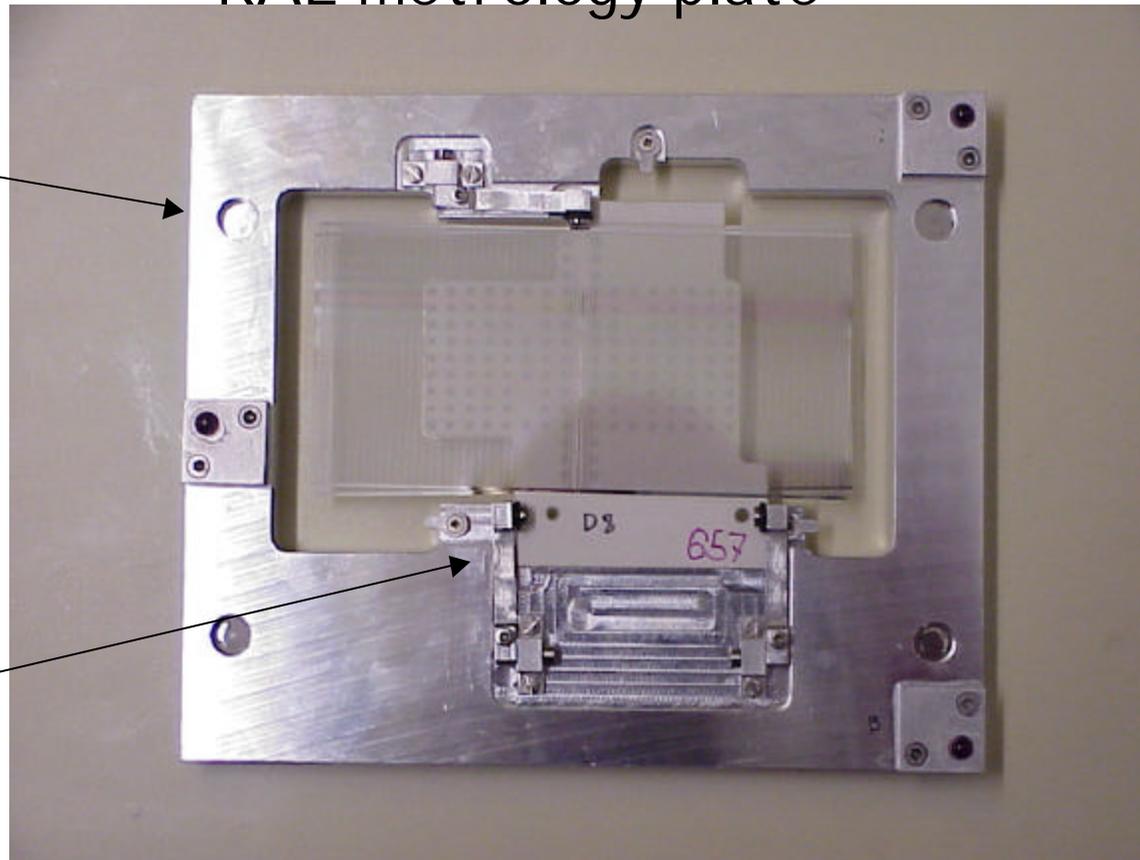


Metrology(2)

RAL metrology plate

Frame
fiducials

Holding
points



Metrology (3)

- 5 dummy modules (D4-8) have been constructed on alumina baseboards with epoxy holes
- Data extracted to provide software corrections for fixture offsets
- Modules D7 and D8 are within spec.
- Module D6 is out of tolerance by 1.5 micron

Metrology of D7

Physics frame results for the same module. ref TB-0059-601-02						
Parameter	Units	Measure	Expect	Tolerance	Deviation	Status
Mhx	μm	-6498.1	-6500	30	-1.9	OK
Mhy	μm	-36989.7	-37000	30	-10.3	OK
Msx	μm	38447.4	38500	100	52.6	OK
Msy	μm	-36982.7	-37000	30	17.3	OK
Sepf	μm	64093.7	64090	10	-3.7	OK
Sepb	μm	64090.4	64090	10	0.4	OK
Midxf	μm	3.6	0	10	3.6	OK
Midyf	μm	2.4	0	5	2.4	OK
Stereo	mrad	-20.065	-20.000	0.130	-0.065	OK
a1	mrad	0.027	0.000	0.130	0.027	OK
a2	mrad	0.009	0.000	0.130	0.009	OK
a3	mrad	-0.047	0.000	0.130	-0.047	OK
a4	mrad	-0.044	0.000	0.130	-0.044	OK

Metrology of D7 (2)

Top to Bot compare		
	x	y
FF1	0	0
FF2	0.770923	0
FF3	1.702637	-1.2326
FF4	1.655593	-1.584
Hole	-5.64377	3.91489
Slot	54.16151	0.36078

Comparison of top and bottom sides using frame fiducials and hole and slot.

Out-of-plane metrology

- Shims established for gluing to control thickness.
- Glue layers measured at ~75 microns.
- Automated Z measurement procedure running on Smart Scope.
- Interface into spreadsheets in progress.
- All new modules have been Alumina dummies: Z effects not relevant.
- Strongly favor a configuration where the module is held as **on the barrel.**
- Thermal effects should be parametrised in bench test.

Testing and burn-in

- Hybrid and module testing capability in place and in use.
- Results shown at Oct SCT week on 2 electrical modules built in mid-2001.
- DAQ components (Mustards etc) for test and burn-in at LBL and UCSC.
- Burn-in hardware can handle 18 units at a time (12 hybrids, 6 modules) : issue of required burn-in time

Path to qualification (1)

- All fixturing and tools are in place. (NOW)
- Establish consistency of in-plane results on small number of additional dummy modules with Alumina. (~1 week)
- Can send a dummy to another site for cross check.
- Commission Z measurement process. (1-2 weeks)
- Build dummies on PG baseboards (2-3) to document Z is in spec. (early March)
- Construct 1 or 2 pre-qualification series electrical modules (mid-March)
- Construct qualification series. (late March-April)

Path to qualification (2)

- Additional components will be required to meet these goals.
 - Alumina baseboards – more expected
 - PG baseboards – 2 in hand with old style washers, much prefer either epoxy hole or new washers.
 - Hybrids – OK
 - Dummy detectors – OK
 - Detectors – 8 in hand for pre-qual series, will need 20 for qualification series.

Summary

- Infrastructure ready
- Good results on dummy parts
- Z work in progress
- Some components needed to advance qualification process
- Expect to qualify in April '02